Mystery Electronic Switches

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🔧 TOOLS:

- **Desoldering tool (1)**
  from RadioShack, or use a desoldering braid.
- **Drill (1)**
  or drill press.
- **Drill bit (1)**
- **File (1)**
- **Heat gun (1)**
  or hair dryer.
- **Miscellaneous tools (1)**
  to disconnect the circuit board and its batteries, if needed. You might use needlenose pliers, wire cutters/ strippers, or a heat gun or hair dryer to melt glue or shrink heat-shrink tubing.
- **Multimeter, 17-range analog (1)**
  from RadioShack.
- **Needlenose pliers (1)**
- **Saw (1)**
  for cutting plastic.
- **Soldering Iron, 15 Watt (1)**
  from RadioShack.
- **Wire cutter and stripper (1)**
  from RadioShack.

⚙️ PARTS:

- **Hookup wire, 22 gauge, multiple colors (1)**
  from RadioShack.
- **Batteries AAA (2)**
  from RadioShack.
- **Battery holder, 2xAAA (1)**
  from RadioShack.
- **Antiperspirant container (1)**
  as big as possible
- **Electronic Hallmark Halloween or Christmas card (1)**
  You might want to buy a few different ones; some circuit boards are easier to use than others.
- **Magnetic reed switches (2)**
  Jameco #171872
- **Switches (3)**
- **Magnetic ring (1)**
  Search online for Wizard PK rings. These come in silver and gold and are available in 8 different metric sizes (convert U.S. ring sizes at http://onlineconversion.com/ring_size.htm).
- **Solder, lead-free (1)**
  from RadioShack.
- **Capacitor 0.22 F (1)**
  from RadioShack.
- **Resistor, 500-piece assorment, 1/4 Watt (1)**
  from RadioShack.
- **Switch, SPDT, Center Off (3)**
 *from RadioShack.*

SUMMARY

Everyone loves a good mystery. Give someone this nifty magic gadget and tell them there's a way to toggle the switches that will make its LEDs light up. No matter who else tries it, or how long they keep toggling the switches, the LEDs will never light up -- until you do it.

Revealing the Mystery

(Spoiler Alert!) A good illusionist never discloses the secret that makes a trick work. Once you do, the magic has ended. With that said, I'll break the magician's code and reveal how the circuit works: inside the container are two reed switches that can be activated by a magnet. You wear a special magnetic ring that activates them. To show off your unique ability to make the LEDs light up, you just hold your finger with the magnetic ring alongside one of the reed switches. This project only took two evenings to design, build, and test. Check out more [Weekend Projects](#).

## Step 1 — Find and extract a donor greeting card circuit.
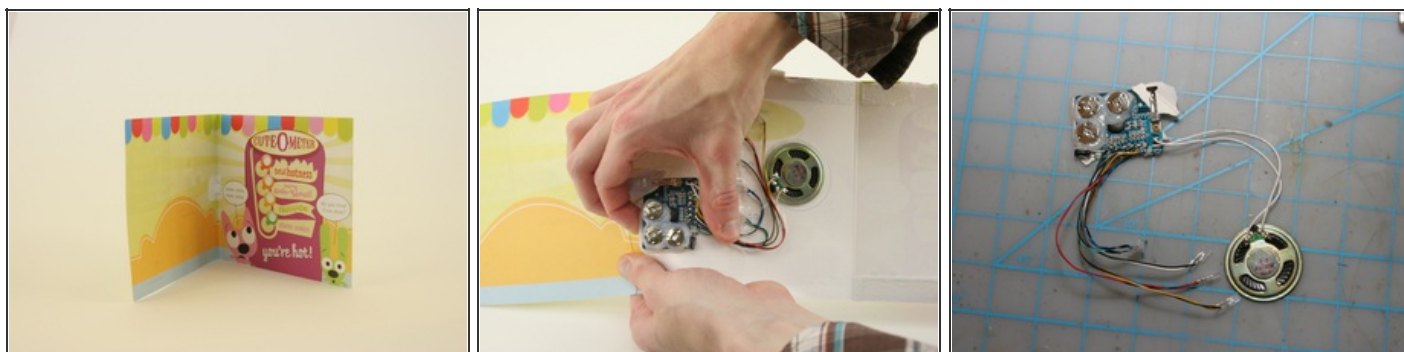
- Look for a greeting card with LEDs. Some cards also have a speaker, which can be a bonus if you want your mystery switch box to play sound as well. I used a Hallmark Christmas card.
- Remove the printed circuit board (PCB) from the greeting card.

Step 2 — Remove the batteries.
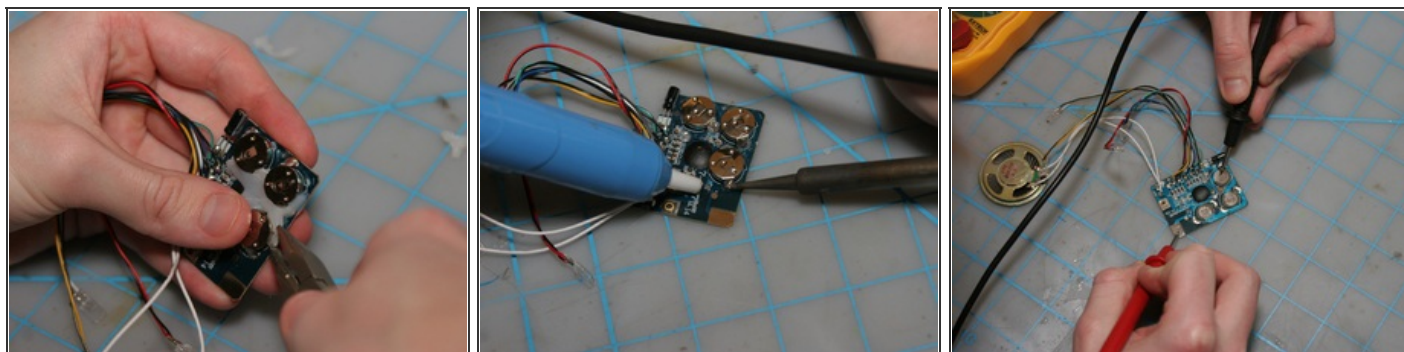
- Use pliers to pick away any glue holding the batteries to the PCB.
- Use a soldering iron and solder sucker (or desoldering braid) to desolder the battery holders from the PCB.

Step 3 — Find the power and trigger contacts.
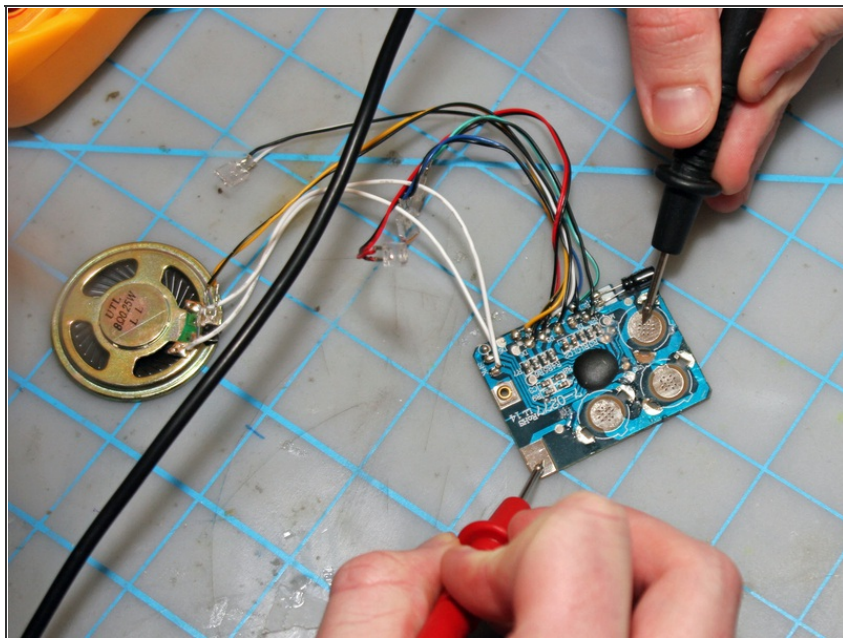
- Identify the positive and negative (ground) contacts on the PCB. Supplying battery voltage across these contacts will make the circuit flash.

- Probe with a multimeter to find the PCB's trigger contact. On my card it was between the PCB ground (–) and battery, but others have the trigger between the positive power (+) and battery.

Step 4 — Build the circuit.
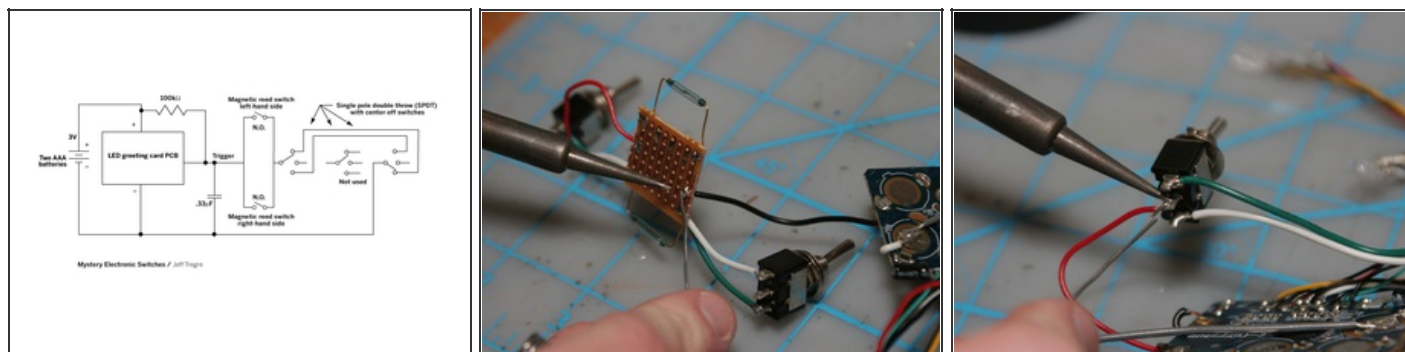
- Refer to the schematic diagram to build the circuit on a small piece of perf board that will fit easily inside your container.
- Connect the two reed switches along opposite sides of the perf board, bent away from the edges so they'll be close to the magnetic ring whichever way you hold the container.
- Along with the reed switches, the perf board carries a 100KΩ resistor and a 0.33µF capacitor.
  - The pull-up resistor, between power (+) and the trigger, avoids EMI noise (electromagnetic interference).
  - The capacitor prevents the LEDs from activating prematurely whenever the switches are touched.
- The rest of the circuit components (greeting card PCB, switches, and battery pack) connect offboard.
- Greeting cards typically run at 3 volts, using 3V coin cells (single or connected in parallel). For longer life, we replace these with a 2xAA battery pack, which also delivers 3V. If your card runs at a higher voltage, match the battery pack accordingly, using two 1.5V batteries for each 3V coin cell.

Step 5 — Prepare the case.

- I used a clear plastic antiperspirant container, so that my audience could see all the working electronics of this circuit. The circuit board fit perfectly into this container, allowing 2 AAA batteries in their holder to fit on the underside.
- Uncap the ends of the container and clean it out.
- Cut away the internal screw.
- If the dispensing end has perforations, cut that end off to open it up, and file the end smooth.

Step 6 — Final Assembly
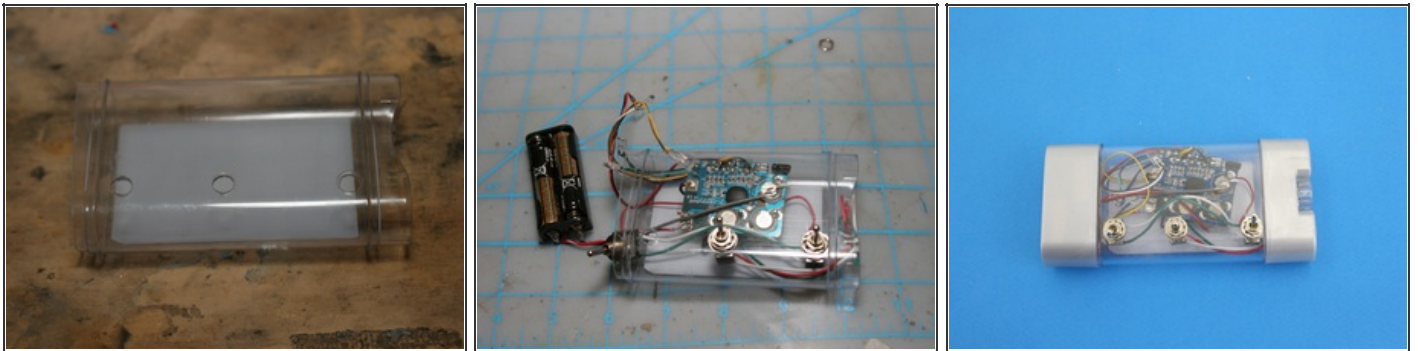
- Drill three holes in the side of the case, for the switches.
- Mount the two switches that connect to the circuit in the holes at either end.
- Solder wires to the unconnected switch (to make it look convincing) and mount it into the middle hole.
- Tuck all the circuitry into the container, and cap each end.

Step 7 — Fool your friends!
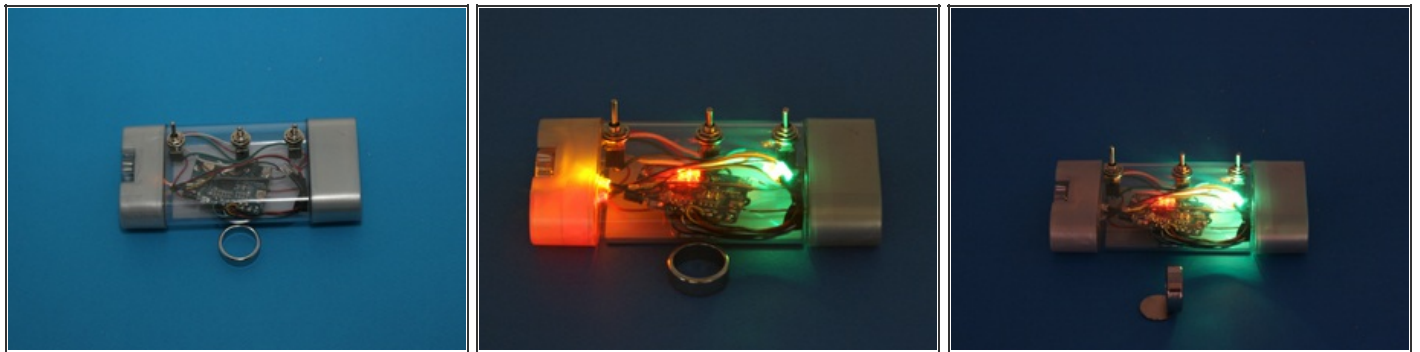
- Now just flip the switches in the correct pattern and the LEDs light up and remain lit for several seconds.

- With the magnetic ring on, the only trick is that the switches at either end must be toggled in opposite directions from each other. The middle switch isn't used at all; it's just there, all wired up for show.

- Practice your performance; the more confident you are, the more your audience will be determined to beat you at your own trick. Never display your trick to the same people more than 2 or 3 times, because someone will figure it out and reveal your secret.

- I tell my audience it's a mathematical algorithm and only I know the sequence to toggle the 3 switches, then I dare them to match my ability to get the LEDs to light up. "Well, do you feel lucky?"

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